

APPENDIX A
**RECONNAISSANCE OVERLAYS, SYMBOLS, AND
FORMULAS**

This appendix provides leaders the necessary data to use overlays, symbols, and formulas in their reconnaissance efforts.

A-1. SYMBOLS

Figure A-1 (pages A-2 through A-6) outlines a variety of symbols that soldiers can use to illustrate reconnaissance data on their overlays. Figure A-2, page A-7, shows an example of how these graphics are used in the overlay. Figure A-3, page A-8, shows symbols for various materials, facilities, equipment, and services. (These graphics are adapted from information provided in FM 5-170.)

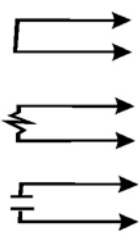

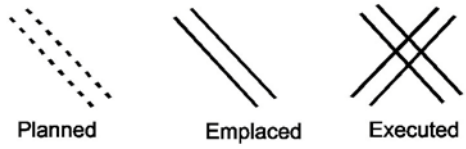
Symbols for use in the reconnaissance overlay	
Symbol	Description and criteria
<p>BYPASSES</p> 	<p>BYPASSES: Are local alternate routes which enable traffic to avoid an obstruction. Bypasses are classified as EASY, DIFFICULT, or IMPOSSIBLE. Each type bypass is represented symbolically on the line extending from the symbol to the main location and defined as follows:</p> <p>BYPASS EASY: The obstacle can be crossed within the immediate vicinity by a US 5-ton truck (or NATO equivalent) without work to improve the bypass.</p> <p>BYPASS DIFFICULT: The obstacle can be crossed within the immediate vicinity, but some work will be necessary to prepare the bypass.</p> <p>BYPASS IMPOSSIBLE: The obstacle can only be crossed by one of the following methods:</p> <ol style="list-style-type: none"> (1) Repair of item, such as bridge. (2) New construction. (3) Detour using an alternate route that crosses the obstacle some distance away.
<p>STEEP GRADES</p> 	<p>STEEP GRADES: (An obstruction.) Any grade 7% or higher. Actual % of grade will be shown. Arrows always point uphill, and length of arrow represents length of grade if map scale permits. (The percent of slope is written to the right of the arrow.)</p>
<p>OBSTACLES</p> 	<p>OBSTACLES: Are natural or manmade restrictions which impede the flow of traffic along a designated route.</p>

Figure A-1. Reconnaissance overlay symbols.

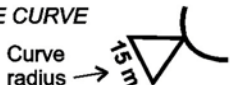
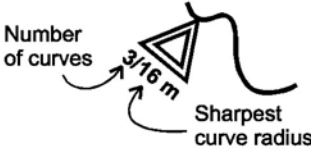

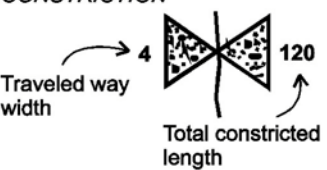
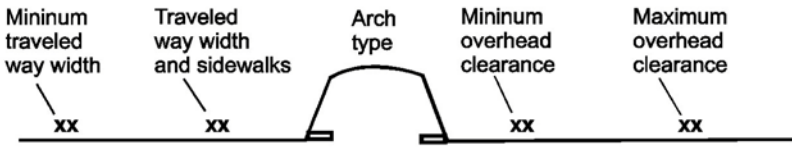
Symbols for use in the reconnaissance overlay	
Symbol	Description and criteria
SINGLE CURVE 	SHARP CURVE: Any curve with a radius of 25 meters or less is an obstruction. All curves with a radius less than 45 meters are reportable.
MULTIPLE CURVES 	SERIES OF SHARP CURVES: The figure to the left indicates the number of curves; that to the right, the minimum radius of curvature in meters.
CRITICAL POINT  Number critical points in order and describe them on DA Form 1711-R.	CRITICAL POINT: A key geographic point or position important to the success of an operation; a point in time, a crisis or turning point, or any point along a route of march where interference with troop movement may occur.
CONSTRUCTION 	CONSTRUCTION: (An obstruction.) Any reduction in the traveled way below the minimum required. The figure to the left indicates the width of the constriction; that to the right, the total constricted length, both in meters.
UNDERPASS 	
ROUTE DESIGNATION (495)	ROUTE DESIGNATION: Civil or military route designation. Written in parentheses along route.

Figure A-1. Reconnaissance overlay symbols (continued).

Symbols for use in the reconnaissance overlay	
Symbol	Description and criteria
BRIDGE <i>Full NATO Bridge Symbol</i>	<p>When full NATO bridge symbol is used on an overlay, the additional information column on the DA Form 1249 will not contain bypass length, traveled way width, or overhead clearance.</p>
BRIDGE <i>Abbreviated Bridge Symbol</i>	<p>When abbreviated symbol is used, DA Form 1249 must be attached.</p>
TUNNEL	<p>TUNNEL: (Includes manmade snow sheds.) Show the shape of structure or obstruction when overhead clearance is less than 4.3 m.</p>

Figure A-1. Reconnaissance overlay symbols (continued).

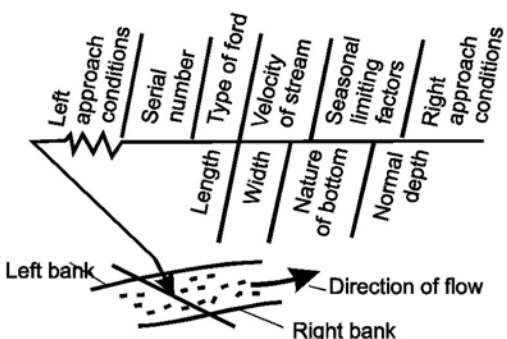
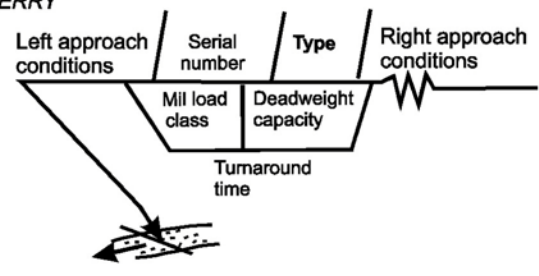
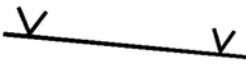
Symbols for use in the reconnaissance overlay	
Symbol	Description and criteria
<p>FORD</p>  <p>FORD: All fords are considered as obstructions to traffic.</p> <p>Type of ford: V-- Vehicular P-- Pedestrian</p> <p>Seasonal limiting factors: X-- No seasonal limitation except for limited duration sudden flooding. Y-- Significant seasonal limitations.</p> <p>Approach conditions: ———— Difficult ————— Easy</p> <p>Nature of bottom: M-- Mud C-- Clay S-- Sand G-- Gravel R-- Rock P-- Artificial paving</p>	
<p>FERRY</p>  <p>FERRY: All ferries are considered as obstructions to traffic.</p> <p>Type of ferry: V-- Vehicular P-- Pedestrian</p> <p>Approach conditions: ————— Difficult ————— Easy</p>	
	<p>LIMITS OF SECTOR: Limits of reconnoitered sector or of route having some road classification formula.</p>

Figure A-1. Reconnaissance overlay symbols (continued).

Symbols for use in the reconnaissance overlay	
Symbol	Description and criteria
RAILROAD CROSSINGS	
	Level grade crossing
	Overhead obstruction
	Combination
RAILROAD (RR) CROSSING: Passing trains will interrupt traffic flow. The figure indicates overhead clearance.	
RAILROAD BRIDGES	

Figure A-1. Reconnaissance overlay symbols (continued).

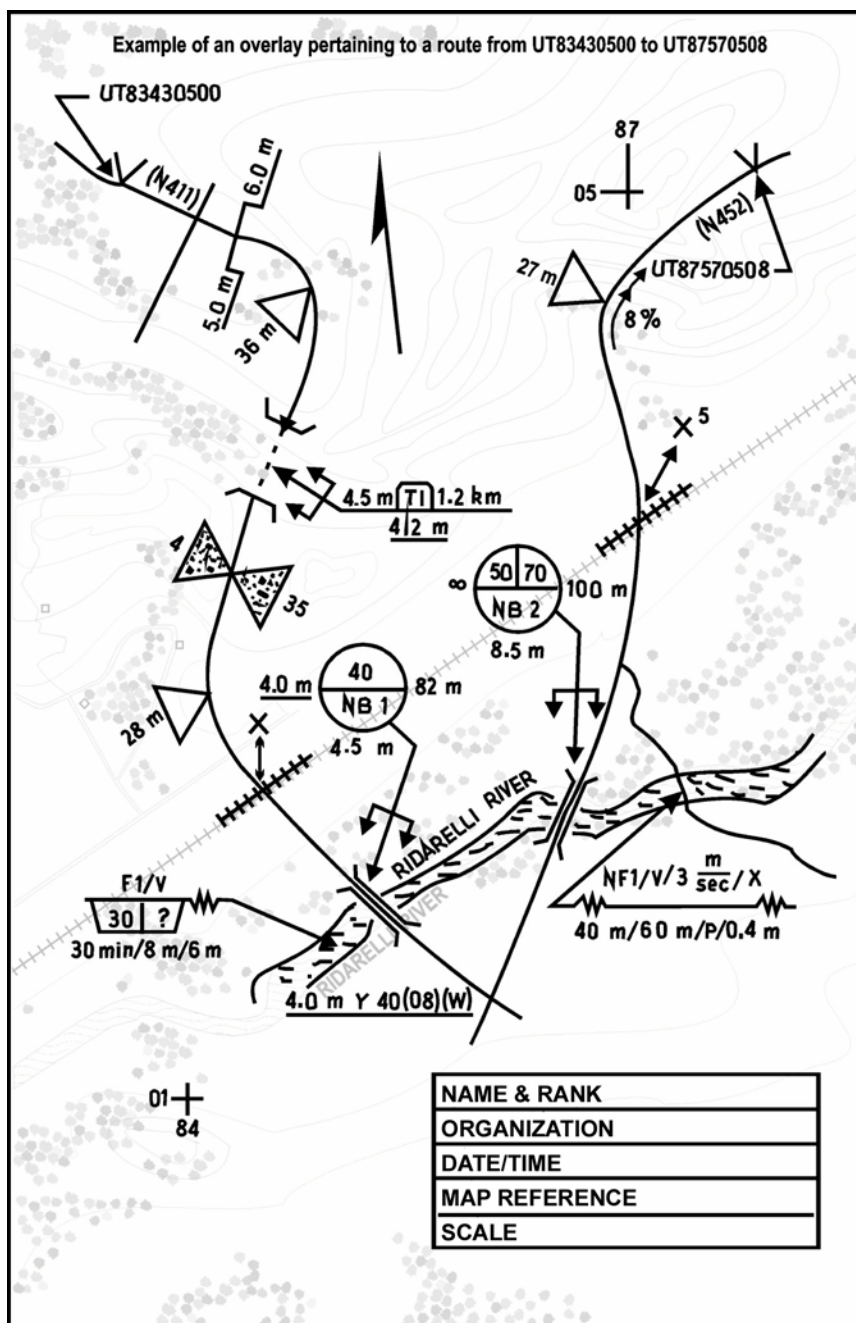


Figure A-2. Example of overlay graphics.



Figure A-3. Material, facility, equipment, and service symbols.

A-2. FORMULAS

This paragraph covers formulas for the reconnaissance platoon to use in water crossing operations and in determining the slope of a road or other piece of terrain. The information is adapted from FM 5-34.

a. Formulas for Water Obstacles.

(1) **Width.** Scouts can measure the width of a river or stream using one of several available methods:

- Stretching a string or measuring tape across the river or stream.
- Using a map scale.
- Using a compass and the basic mathematical computation illustrated in Figure A-4.

(2) **Velocity.** Scouts can measure the velocity of the current of a river or stream using the procedures shown in Figure A-5, page A-10.

b. **Slope Computation.** To determine the slope of a piece of ground, whether it is an established roadway or a cross-country route, soldiers use a clinometer. If a clinometer is not available, they use the slope computation formula, which requires using one of the following methods to determine horizontal and vertical distances (Figure A-6, page A-10):

- Compute horizontal and vertical distances based on the map scale and contour differences for the road or terrain.
- Estimate horizontal and vertical distances using pacing and eyesight (hasty method).

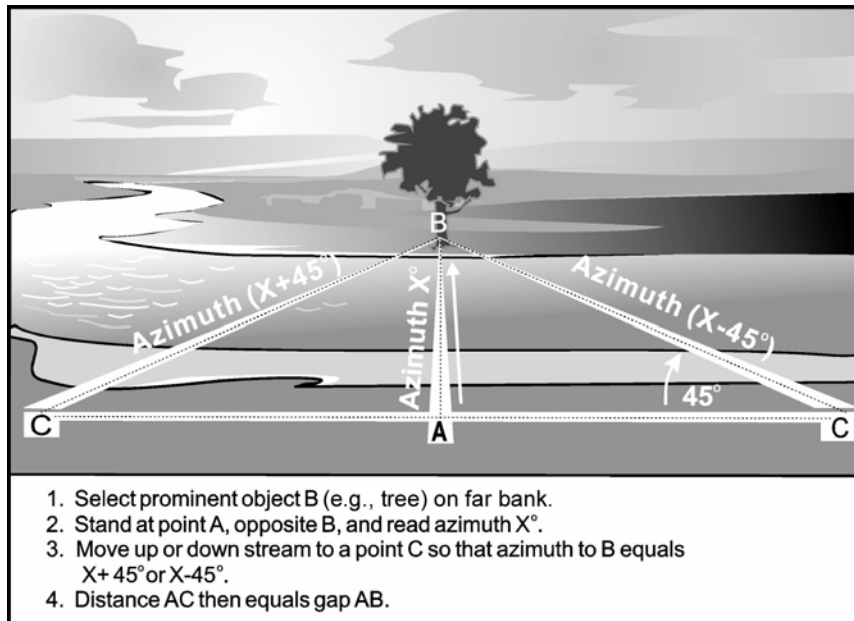


Figure A-4. Measuring stream width with a compass.

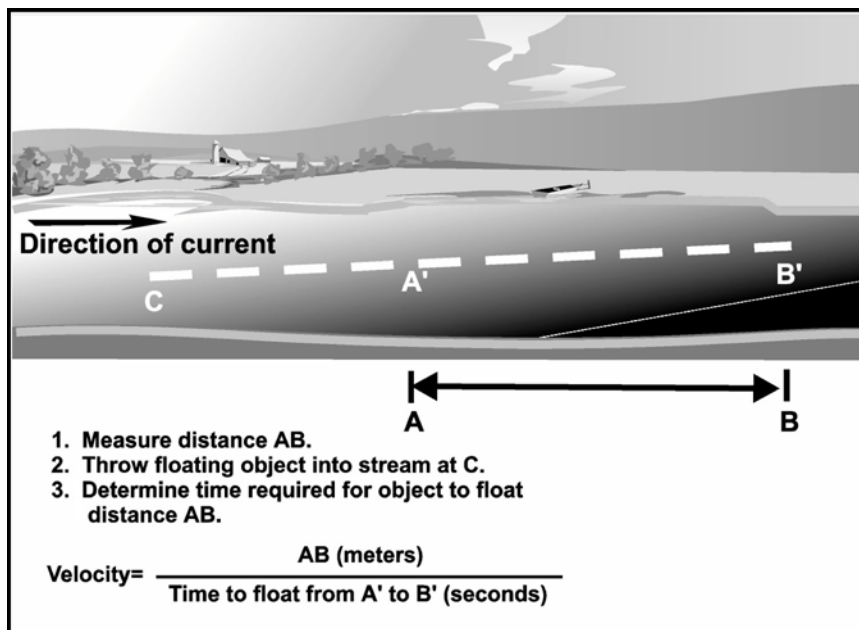


Figure A-5. Measuring stream velocity.

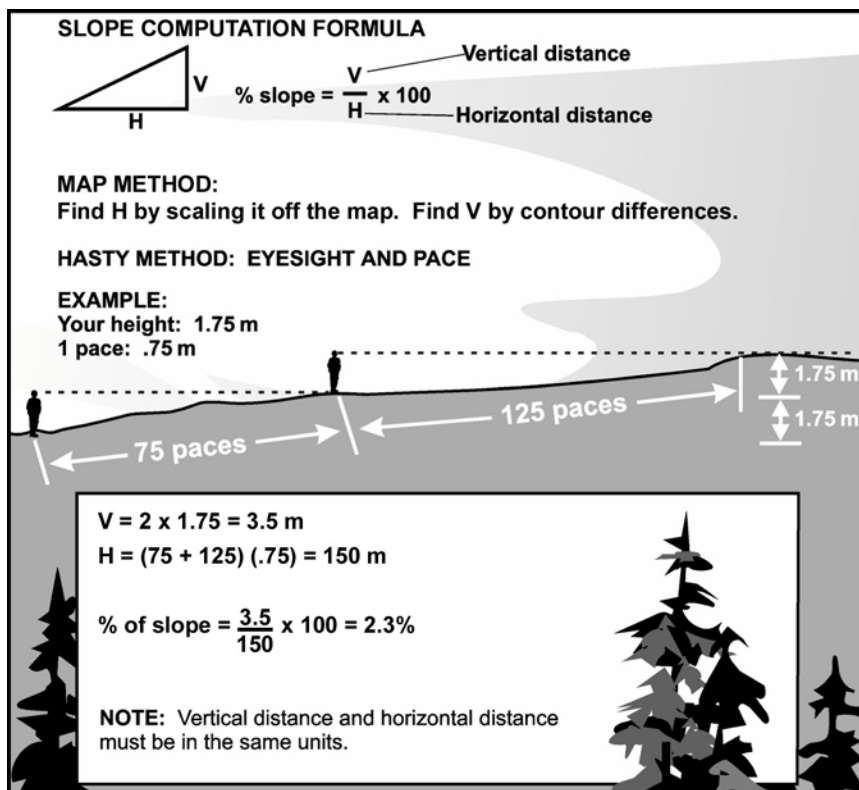


Figure A-6. Slope computation (road gradient).

A-3. CONVERSION TABLES

Soldiers can use the following tables for converting English measurements to their metric equivalents. Table A-1 lists conversions for common distance measurements (inches to centimeters; feet to meters; yards to meters; miles to kilometers). Table A-2, page A-12, shows conversions of miles per hour to kilometers per hour. Table A-3, page A-12, refers to field-expedient antenna lengths.

<p>INCHES to CENTIMETERS</p> <p>1 inch = 2.54 centimeters 2 inches = 5.08 centimeters 3 inches = 7.62 centimeters 4 inches = 10.16 centimeters 5 inches = 12.70 centimeters 6 inches = 15.24 centimeters 7 inches = 17.78 centimeters 8 inches = 20.32 centimeters 9 inches = 22.86 centimeters 10 inches = 25.40 centimeters 20 inches = 50.80 centimeters 30 inches = 76.20 centimeters 40 inches = 101.60 centimeters 50 inches = 127.00 centimeters 60 inches = 152.40 centimeters 70 inches = 177.80 centimeters 80 inches = 203.20 centimeters 90 inches = 228.60 centimeters 100 inches = 254.00 centimeters</p>	<p>FEET to METERS</p> <p>1 foot = 0.30 meters 2 feet = 0.61 meters 3 feet = 0.91 meters 4 feet = 1.22 meters 5 feet = 1.52 meters 6 feet = 1.83 meters 7 feet = 2.13 meters 8 feet = 2.44 meters 9 feet = 2.74 meters 10 feet = 3.05 meters 20 feet = 6.10 meters 30 feet = 9.14 meters 40 feet = 12.19 meters 50 feet = 15.24 meters 60 feet = 18.29 meters 70 feet = 21.34 meters 80 feet = 24.38 meters 90 feet = 27.43 meters 100 feet = 30.48 meters</p>
<p>YARDS to METERS</p> <p>1 yard = 0.91 meters 2 yards = 1.83 meters 3 yards = 2.74 meters 4 yards = 3.66 meters 5 yards = 4.57 meters 6 yards = 5.49 meters 7 yards = 6.40 meters 8 yards = 7.32 meters 9 yards = 8.23 meters 10 yards = 9.14 meters 20 yards = 18.29 meters 30 yards = 27.43 meters 40 yards = 36.58 meters 50 yards = 45.72 meters 60 yards = 54.86 meters 70 yards = 64.00 meters 80 yards = 73.15 meters 90 yards = 82.30 meters 100 yards = 91.44 meters</p>	<p>MILES to KILOMETERS</p> <p>1 mile = 1.61 km 2 miles = 3.22 km 3 miles = 4.83 km 4 miles = 6.44 km 5 miles = 8.05 km 6 miles = 9.66 km 7 miles = 11.27 km 8 miles = 12.87 km 9 miles = 14.48 km 10 miles = 16.09 km 20 miles = 32.19 km 30 miles = 48.28 km 40 miles = 64.37 km 50 miles = 80.47 km 60 miles = 96.56 km 70 miles = 112.65 km 80 miles = 128.75 km 90 miles = 144.84 km 100 miles = 160.93 km</p>

Table A-1. English to metric distance measurement conversions.

MILES PER HOUR	KILOMETERS PER HOUR
1 mph	1.609 kmph
2 mph	3.22 kmph
3 mph	4.83 kmph
4 mph	6.44 kmph
5 mph	8.05 kmph
6 mph	9.66 kmph
7 mph	11.27 kmph
8 mph	12.87 kmph
9 mph	14.48 kmph
10 mph	16.09 kmph
15 mph	24.14 kmph
20 mph	32.19 kmph
25 mph	40.23 kmph
30 mph	48.28 kmph
35 mph	56.33 kmph
40 mph	64.37 kmph
45 mph	72.42 kmph
50 mph	80.47 kmph
55 mph	88.51 kmph
60 mph	96.56 kmph
65 mph	104.61 kmph
70 mph	112.65 kmph
75 mph	120.70 kmph
100 mph	160.94 kmph

Table A-2. Miles per hour to kilometers per hour conversions.

OPERATING FREQUENCY (MHZ)	WIRE/ELEMENT LENGTH
30	2.38 meters (7 feet 10 inches)
32	2.23 meters (7 feet 4 inches)
34	2.10 meters (6 feet 11 inches)
36	1.98 meters (6 feet 6 inches)
38	1.87 meters (6 feet 2 inches)
40	1.78 meters (5 feet 10 inches)
43	1.66 meters (5 feet 5 inches)
46	1.55 meters (5 feet 1 inch)
49	1.46 meters (4 feet 9 inches)
52	1.37 meters (4 feet 6 inches)
55	1.30 meters (4 feet 3 inches)
58	1.23 meters (4 feet 0 inches)
61	1.17 meters (3 feet 10 inches)
64	1.12 meters (3 feet 8 inches)
68	1.05 meters (3 feet 5 inches)
72	.99 meters (3 feet 3 inches)
76	.94 meters (3 feet 1 inch)

Table A-3. Operating frequency and wire element length.